Model 215M

PATIENT SIMULATOR

OPERATING and SERVICE MANUAL

DYNATECH NEVADA
INCORPORATED

2000 ARROWHEAD DRIVE, CARSON CITY, NEVADA 89706
P.O. BOX 1925, CARSON CITY, NEVADA 89702-1925
1-800-648-7952 702-883-3400 FAX: 702-883-9541

2/90

MODEL 215M

Patient Simulator

OPERATOR'S MANUAL

DYNATECH NEVADA
INCORPORATED

2000 Arrowhead Drive, Carson City, Nevada 89706
P.O. Box 1925, Carson City, Nevada 89702-1925
1-800-648-7952 702-883-3400 Fax: 702-883-9541

WARRANTY

WARRANTY

The terms and conditions of warranties made by Dynatech Nevada, Inc. with respect to its products are as set forth in its standard terms and conditions of sale included herein by reference. Pursuant to these provisions, Dynatech Nevada Inc. warrants that all products are to be free from defects in workmanship and materials as set forth in the warranty policy to follow, unless a different period is specified, after delivery to the customer. If notice of the defect is timely given, Dynatech Nevada will either modify the product or part to correct the defect, replace the product or part with either new or factory reconditioned complying products, or refund the amount paid for the defective product or part. The standard terms and conditions of sale are printed on the reverse side of the company's invoice and acknowledges of customer's order forms, and additional copies thereof may also be obtained from the company's offices.

CERTIFICATION

This instrument was thoroughly tested and inspected and found to meet our manufacturing specifications as published when it was shipped from the factory. Calibration measurements are traceable to the National Institute of Standards and Technology (N.I.S.T.)

COPYRIGHT RELEASE

Dynatech Nevada, Inc. agrees to a limited copyright release to allow the customer to reproduce manuals and other printed materials furnished under the applicable contracts for use in a service training program and other technical publications. Any other reproduction or distribution will only be considered for release by Dynatech Nevada Inc. after submittal in writing by the requesting organization.

NEW INSTRUMENTS

ONE YEAR ON PARTS
ONE YEAR ON LABOR
PHYSICAL DAMAGE NOT COVERED

REPAIR INSTRUMENTS

90 DAYS ON CALIBRATION
90 DAYS ON LABOR
90 DAYS ON PARTS REPLACEMENT
PHYSICAL DAMAGE IS NOT COVERED

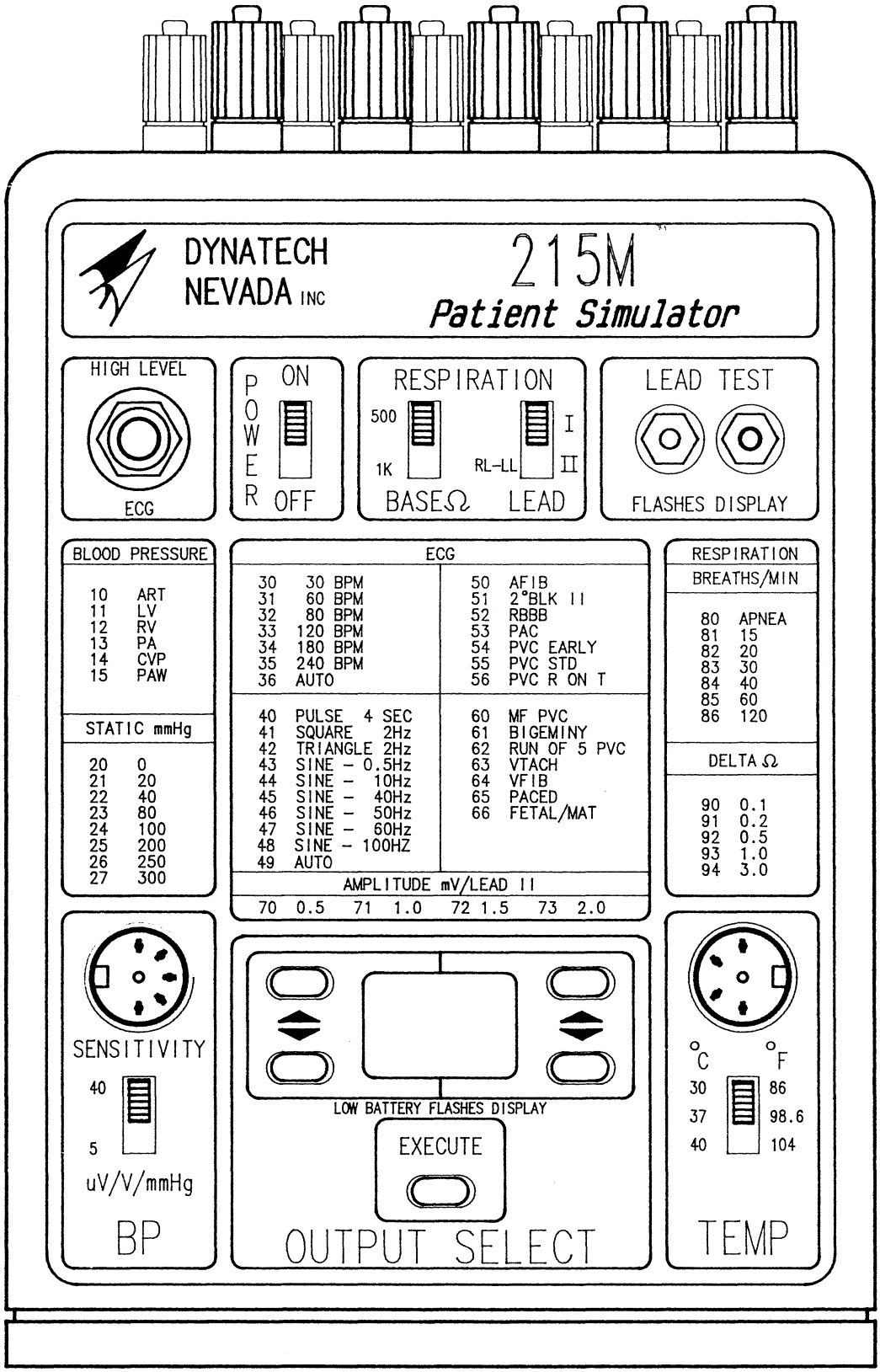


FIGURE 0-1

215M PATIENT SIMULATOR

TABLE OF CONTENTS
4-4-90

SECTION 1	SPECIFICATIONS	PAGE 1-1
SECTION 2	INSTALLATION	PAGE 2-1
SECTION 3	OPERATION	PAGE 3-1
SECTION 4	PERFORMANCE CHECK AND CALIBRATION	PAGE 4-1
SECTION 5	CIRCUIT DESCRIPTION	PAGE 5-1
SECTION 6	PARTS LIST	PAGE 6-1
SECTION 7	SCHEMATICS	PAGE 7-1

LIST OF ILLUSTRATIONS

FIGURE 0-1	MODEL 215M	PAGE 0-5
FIGURE 3-1	CONTROLS AND FUNCTIONS	PAGE 3-3
FIGURE 3-2	UNTERMINATED BP CABLE	PAGE 3-7
FIGURE 4-1	ADJUSTMENT LOCATOR	PAGE 4-5
FIGURE 5-1	BLOCK DIAGRAM	PAGE 5-3
FIGURE 7-1	COMPONENT LOCATOR	PAGE 7-3
FIGURE 7-2	SCHEMATIC 1	PAGE 7-5
FIGURE 7-3	SCHEMATIC 2	PAGE 7-7

ATTENTION: MANUFACTURERS/IMPORTERS OF PATIENT MONITORING OR ECG DIAGNOSTIC EQUIPMENT.

The model 215M patient simulator is intended to be used as a simulation device only. Recommended applications include routine preventive maintenance inspections and as a sales demonstration or training tool. The model 215M patient simulator is not to be used as the primary calibration standard or the certification test instrument for medical devices.

5/10/90

SECTION 1

SPECIFICATIONS

INTRODUCTION

The Model 215M is a high performance patient simulator which includes simulation of ECG, respiration, dynamic blood pressure and static temperature. All functions are set from a 2 digit display operated by a 5 switch keyboard and 5 slide switches. The unit has 3 electrically isolated sections. The main section contains ECG and respiration. Blood pressure is in another isolated section. Temperature is in the third isolated section.

ECG

ECG configuration is 12 lead with independent outputs for each signal lead referenced to RL. A HIGH LEVEL ECG output is also included. Waveforms include NSR from 30 to 240 BPM, performance waveforms, paced and a selection of arrhythmias. Amplitude is adjustable on all waveforms.

NORMAL ECG

RATES: 30, 60, 80, 120, 160, 200, 240 BPM. Accuracy is 1%. Auto steps through the rates at 30 second intervals.

AMPLITUDES: 0.5mV, 1.0mV, 1.5mV and 2.0mV on lead II. Accuracy is 5%. The high level output is approximately 0.5V per mV of the low level output.

IMPEDANCE: Limb leads are selectable at 500Ω and 1000Ω. V leads are 1000Ω. Accuracy is 5%.

ECG PERFORMANCE

Amplitudes set by ECG AMPLITUDE.

SQUARE: Rate is 2 Hz.

PULSE: 4 Seconds.

TRIANGLE: 2 Hz

SINE: 0.5 10, 40, 50, 60 and 100 Hz

AUTO: Starts at a 2 Hz square wave. Depress the execute key to advance the waveform to pulse. After one pulse it automatically steps through the sine waves at 2 second intervals. The sequence holds at the triangle wave until the execute key is pressed again. The square wave will then resume.

OTHER WAVEFORMS

AFIB, 2°BLK II, RBBB, PAC, PVC EARLY, PVC STD, PVC R ON T, MF PVC, BIGEMINY, RUN OF 5 PVC, VTACH, VFIB, PACED, and FETAL/MAT.

BLOOD PRESSURE

INPUT/OUTPUT IMPEDANCE: 300 ohms

EXCITER INPUT VOLTAGE RANGE: 2 to 16 V

EXCITER INPUT FREQUENCY RANGE: DC to 4000 Hz

OUTPUT SENSITIVITY: 5 or 40 uV/V/mmHg

OUTPUT RANGE: 0 to +300 mmHg

ACCURACY: 1% of range + 1 mmHg at 80 BPM, normal sinus ECG only.

RATES: All dynamic pressures track all normal sinus rates and physiologically track all arrhythmias.

ISOLATION: BP is electrically isolated from the rest of the unit.

WAVEFORMS:

ATM (0 mmHg)
ARTERIAL (120/80 mmHg)
LEFT VENTRICLE (120/0 mmHg)
RIGHT VENTRICLE (25/0 mmHg)
PULMONARY ARTERY (25/10 mmHg)
PAW (10/2 mmHg)
STATIC: 0, 20, 40, 80, 100, 200, 250, 300 mmHg

RESPIRATION

OUTPUT CONFIGURATION: Lead I, II or RL-LL

BASELINE IMPEDANCE: 500 or 1000 ohms. Accuracy is 5%.

DELTA IMPEDANCE: 0, 0.1, 0.2, 0.5, 1.0 and 3.0 ohms. Accuracy is 10%.

RATES: APNEA, 15, 20, 30, 40, 60, and 120 BrPM. Accuracy is 5%.

TEMPERATURE

SELECTIONS: 30°, 37°, 40°. Accuracy is .4°C.

PROBE COMPATIBILITY: 400 and 700 series YSI types

ISOLATION: Electrically isolated from the rest of the instrument

POWER REQUIREMENTS

9V battery. 50 hour life. Battery eliminator optional.

STANDARD ACCESSORIES

Soft Vinyl Carrying Case

Instruction Manual

OPTIONAL ACCESSORIES

Battery Eliminator (UL approved)

BP Cable, unterminated. DNI part no. 3010-0048.

BP Cable, prewired for selected patient monitors. Consult current price list.

Temperature Cable for 400 YSI. DNI part no. 3010-0192.

Temperature Cable for 700 YSI. DNI part no. 3010-0193.

Calibration Cables
Blood Pressure, DNI part no. 3010-0205.
Temperature, DNI part no. 3010-0288.

PHYSICAL CHARACTERISTICS

HEIGHT: 1.8 inches
WIDTH: 4.0 inches
LENGTH: 7.4 inches
WEIGHT: 2.0 pounds

TEMPERATURE REQUIREMENTS

OPERATING: 59°F to 95°F (15°C to 35°C)
STORAGE: 32°F to 131°F (0°C to 55°C)

STORAGE

Store in the supplied carrying case with the battery removed. Store in dry area within storage temperature limits. There are no other storage requirements.

PERIODIC MAINTENANCE

It is recommended that the unit be calibrated at 6 month intervals.

INTENDED USE

The model 215M is intended for use in hospitals to check the operation of patient monitors. It is not intended for calibration purposes.

SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE

SECTION 2

INSTALLATION

INTRODUCTION

This section contains information for making a visual and electrical inspection of the instrument, processing a claim, repackaging for shipment, and installation procedures.

UNPACKING AND INCOMING INSPECTION

Standard receiving practices should have been followed upon delivery of the instrument; i.e., the shipping carton should have been checked for damage and if damage was found, the carrier's agent should have been asked to be present while the instrument was unpacked. There are no special unpacking instructions but care should be taken to not damage the unit. Inspect the unit for physical damage, such as bent or broken parts, dents or scratches.

CLAIMS

If physical damage is found or operation is not within specifications when the instrument is received, notify the carrier immediately. Please read the sheet on damage and shortage in the back of the manual. If Dynatech Nevada or the factory representative is notified, arrangements will be made for repair or replacement of the instrument without waiting for settlement of carrier's claim, however, a new purchase order must be issued to cover this work.

WARRANTY REPAIR

The warranty statement for all Dynatech Nevada products is printed on the back side of the title page of this manual.

The warranty does not cover the cost of transportation. No C.O.D. shipment will be accepted without prior authorization. All transportation and phone charges will be billed to the customer.

It is recommended that United Parcel Service or Air Parcel Post be used to return the instrument to the factory. Please follow the guidelines given above when packaging the instrument to avoid delay or damage.

REPACKAGING FOR SHIPMENT

When shipping an instrument to Dynatech Nevada, attach a tag describing the required services and include Model number, Serial number, and return address.

Use the original carton and packaging material for shipment. If they are not available, use the following guide for repackaging:

a) Use a double walled carton of sufficient strength for the weight to be shipped.

b) Use heavy paper or cardboard to protect all instrument surfaces. Use a non-abrasive material around all projecting parts.

c) Use at least four inches of tightly packed industrial approved shock-absorbent material around the instrument.

PREPARATION FOR USE

The Model 215M is a portable instrument designed for battery operation.

Contact Dynatech for special cables.

SECTION 3

OPERATION

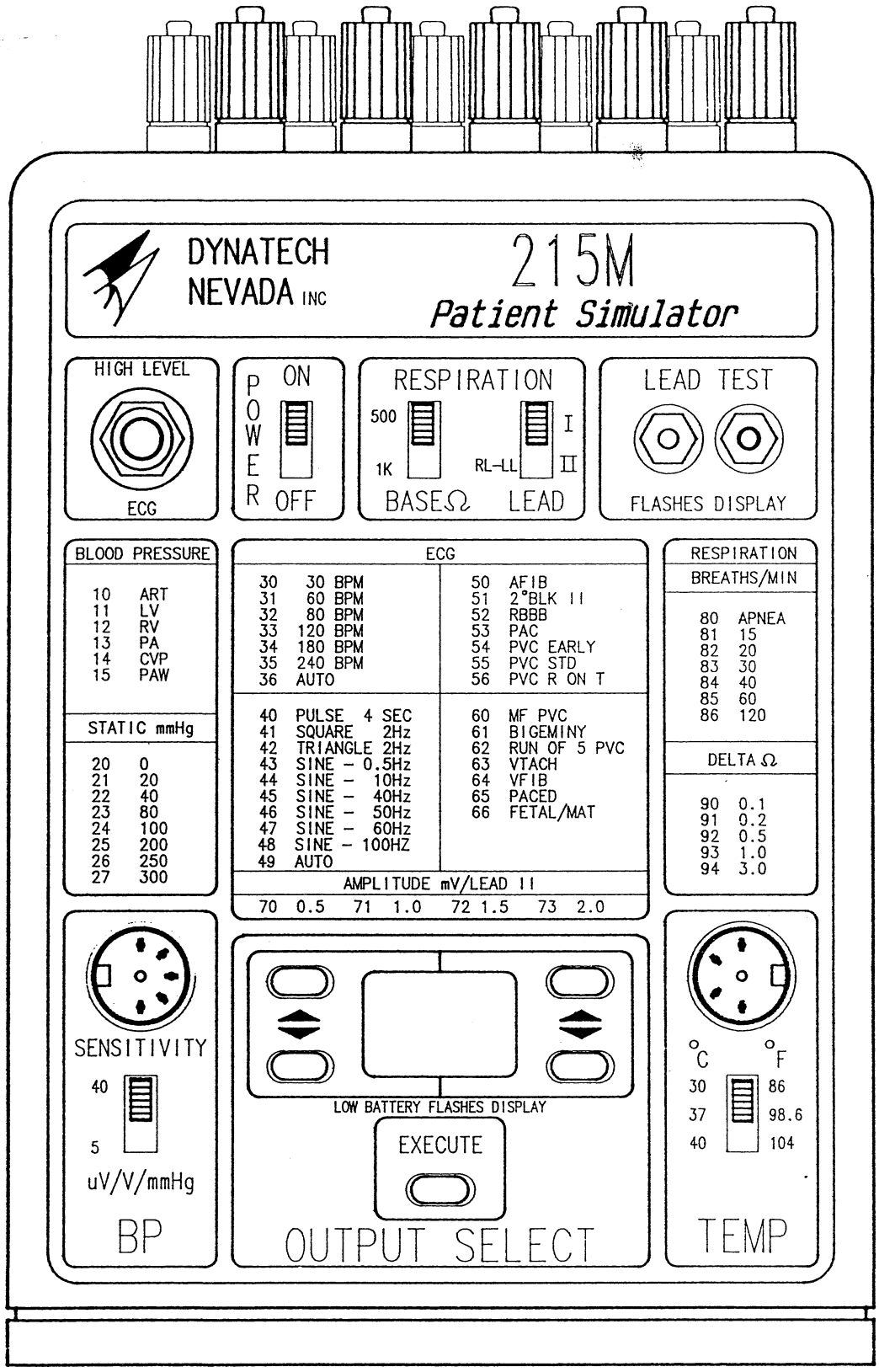


FIGURE 3-1

MODEL 215M CONTROLS and INDICATORS

INTRODUCTION

This section contains operating instructions and explanations of the controls and indicators (figure 3-1) for the Model 215M Patient Simulator.

POWER

The power switch is a slide switch located on the top panel. To increase battery life, turn the instrument off when not in use. The display will indicate a low battery condition by flashing.

BATTERY REPLACEMENT

The battery compartment is accessible from the bottom of the unit. Replace with one 9 Volt alkaline battery (Duracell MN1604 or equivalent).

NOTE: Do not use mercury, air, or carbon-zinc batteries.

TOP PANEL CONTROLS AND CONNECTORS

DISPLAY AND KEYBOARD

The 215M has a two digit display. Above the display on the top panel is a list of the available waveforms and an associated 2 digit number. To execute a waveform, set its number in the display using the 4 increment/decrement keys directly to the left and right of the display. Then execute the waveform with the execute key.

HIGH LEVEL ECG OUTPUT

A lead II waveform at .5V per mV of the low level lead II signal is output at the High Level ECG jack (a 1/4 inch standard phone jack), located on the top panel of the 215M. For use with high level input monitors.

RESPIRATION

The respiration signal is contained within the ECG leads. The LEAD SELECT switch determines which lead it is on. This must be set to correspond to the type of patient monitor used. The BASELINE IMPEDANCE switch sets the impedance between any two limb leads. Respiration parameters (breaths/min) are set and executed from the keyboard of the 215M.

BLOOD PRESSURE

Cables to connect to the blood pressure connector are available from Dynatech (figure 3-2). For many monitors, the cables are available pre-wired. Unterminated cables are available for other monitors. The SENSITIVITY switch must be set to match the patient monitor's input sensitivity (either 5 or 40 uV/V/mmHg). Waveform is determined by the 215M keyboard.

TEMPERATURE

Cables to connect to the temperature connector are available from Dynatech. The type of cable used determines the type of probe simulated, either 400 or 700 series YSI probes. Temperature is selectable by a slide switch.

LEAD TEST

Tests continuity of ECG leads. Connect each end of the lead to be tested to the two lead test terminals. Display flashes if the lead is good.

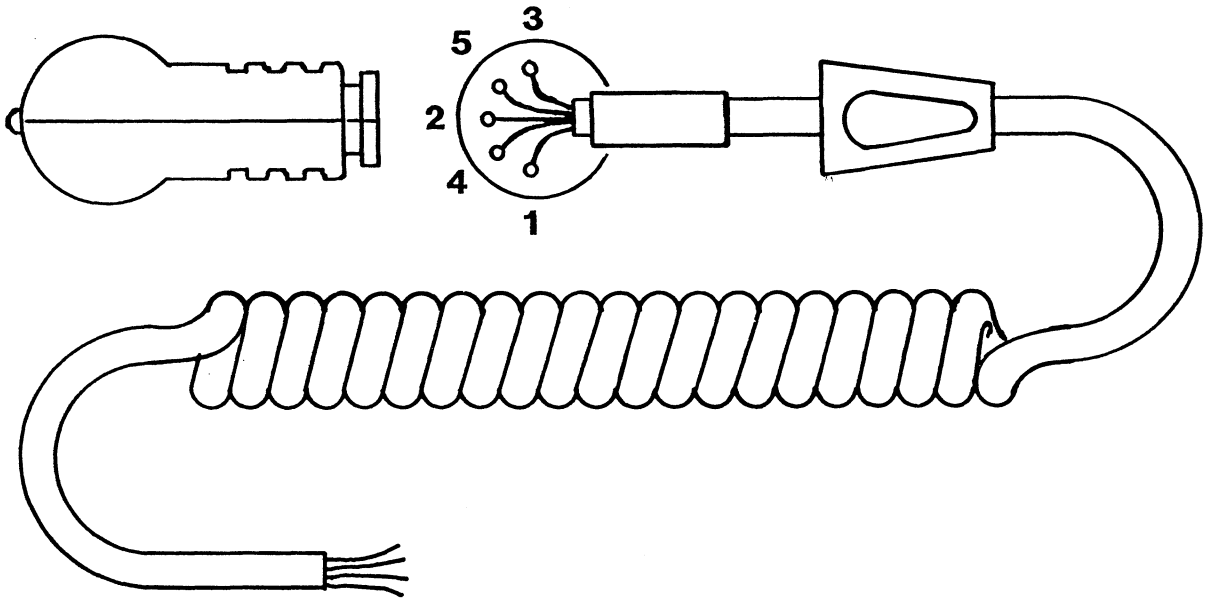
REAR PANEL CONNECTORS

ECG LEADS

Ten special binding posts are compatible with disposable snaps and 3.2mm or 4mm electrodes and banana plugs. Waveform parameters are selectable from the keyboard.

BATT ELIM

The unit has a micro jack for the battery eliminator option. Use only eliminators supplied by Dynatech.



WIRING TABLE

FUNCTION	COLOR	PIN NO
OUTPUT(+)	BLACK	4
OUTPUT(-)	RED	1
EXCITER(+)	WHITE	3
EXCITER(-)	GREEN	5
ECG REF	BLUE	2

Patient Simulator
B.P. OUTPUT CABLE ASSEMBLY

FIGURE 3-2

SECTION 4

PERFORMANCE CHECK AND CALIBRATION

PERFORMANCE CHECK

The following procedure completely checks out the operation of the 215M.

EQUIPMENT REQUIRED

PATIENT MONITOR with ECG, respiration, blood pressure, temperature and cardiac output.

INTERCONNECT CABLES for the above functions. These are available from Dynatech for most monitors.

DIGITAL MULTIMETER.

The 215M operating modes are selected from the keyboard on the 215M. See the operating procedure for details. See specifications for tolerances.

1. Install a battery and turn the 215M on. The display will read the software revision, then after a few seconds it reads 32.

2. Short the LEAD TEST terminals together and the display should flash.

3. Check the resistance between RL and each of the other limb leads (RA, LA, LL) in both BASELINE IMPEDANCE switch positions. When measuring LL, set the lead switch to I. When measuring LA, set the lead switch to II. Resistance tolerances: 475-525 and 950-1050. Return the BASELINE IMPEDANCE switch to 500Ω.

4. Check that the resistance between V1 and each of the other V leads is 950-1050Ω.

5. Connect the ECG posts on the 215M to the monitor. Set the Model 215M to 80BPM and 1mV. Check the rate and amplitude on the monitor.

6. Set the monitor to measure respiration. Set the LEAD SELECT SWITCH for the lead the monitor uses. Set the Model 215M for 20BrPM and 1Ω. Check the rate on the monitor.

7. Connect the BLOOD PRESSURE to the monitor. Set the SENSITIVITY SWITCH as required for the monitor. Set the 215M to ATM and zero the monitor. Set the 215M to 300mm and the monitor should read 300mm.

8. Connect the monitor to the temperature channel. Check the monitor reading in all three temperature switch settings.

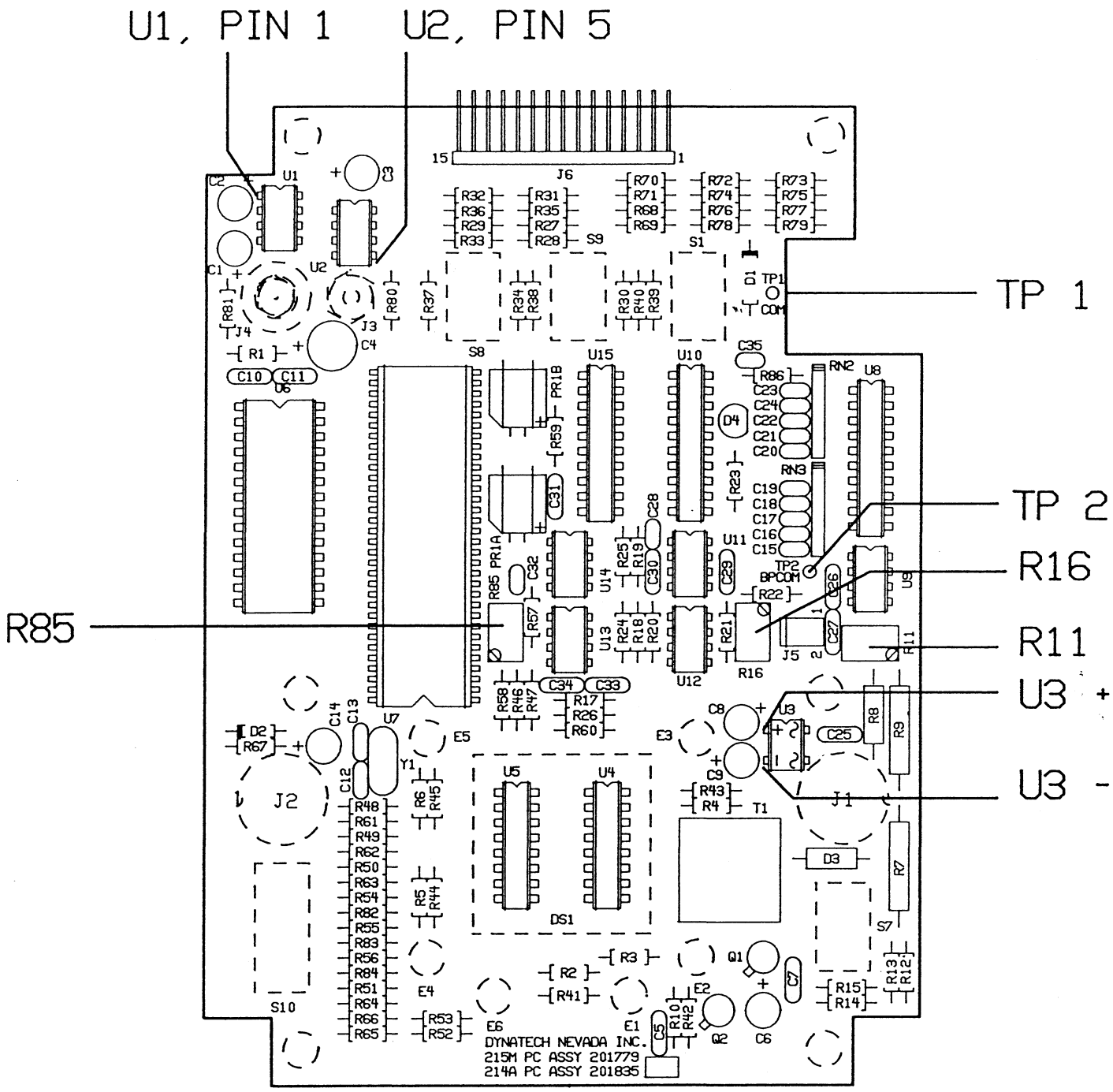


FIGURE 4-1
ADJUSTMENT LOCATOR

CALIBRATION

This section includes the procedure for a complete calibration of the 215M. Refer to figure 4-1 for the location of all adjustments.

EQUIPMENT REQUIRED

DIGITAL MULTIMETER: 5½ digit

DC VOLTAGE SOURCE: 10V ± 10mV @ 30mA

CALIBRATION CABLES: available from Dynatech
Blood Pressure DNI part no. 3010-0205.

SETUP

Remove the four screws on the bottom cover. Pull the bottom cover off.

Set the top panel switches as follows.

BASELINE IMPEDANCE 500
LEAD SELECT II
SENSITIVITY 40

CALIBRATION PROCEDURE

1. Turn the Model 215M on. Test the power supplies using the following chart. All readings in volts.

TEST POINTS	LOW LIMIT	HIGH LIMIT
U1 pin1 - TP1(low)	+4.75	+ 5.25
U2 pin5 - TP1(low)	-5.00	-10.00
U3 pin+ - TP2(low)	+4.70	+ 5.20
U3 pin- - TP2(low)	-4.70	- 5.20

2. Check for at least 1MΩ between TP1 and TP2.

3. Turn the power off. While depressing the EXECUTE switch turn the power back on. This enters the calibration procedure. The display should read 00.

4. Connect a DMM to LL and RA (low). Execute a display setting of 00. Record the DMM voltage reading (typically < .1mV).

5. Set the display to 01 and execute it. Adjust R16 for the voltage to be 2mV plus the voltage measured in step 19. Be sure to include the voltage polarities when adding the readings. The adjustment tolerance is ±.020mV.

6. Connect the DMM to LL and RA (low). Set the display to 02 and execute it. Record the DMM resistance reading (typically 500 ± 25Ω).

7. Set the display to 03 and execute it. Adjust R85 for the reading in step 6 plus 3Ω.

8. Repeat steps 6 and 7 until the difference between the reading is 3 ± .03Ω.

9. Move the DMM to LA and RA. Set the BASELINE IMPEDANCE SWITCH to lead I. Remeasure the resistance using the procedure in steps 6 and 7 but do not readjust R85. The result should be 3 ± .3Ω.

10. Connect a blood pressure calibration cable (DNI# 3010-0205) to the blood pressure connector. Connect the other end of the cable to a +10V power source and the DMM as shown in the following chart.

CABLE WIRE	CONNECTION
GRY	+10 V
GRN	GND FOR 10V
BLK	+DMM
RED	-DMM

With the cable connected check that the +10V voltage source is 10 ± .01V.

11. Set the display to 04 and execute it. Record the DMM voltage reading (typically < 1mV).

12. Set the display to 05 and execute it. Adjust R11 for the reading in step 12 plus 120mV. The adjustment tolerance is .2mV.

SECTION 5

CIRCUIT DESCRITION

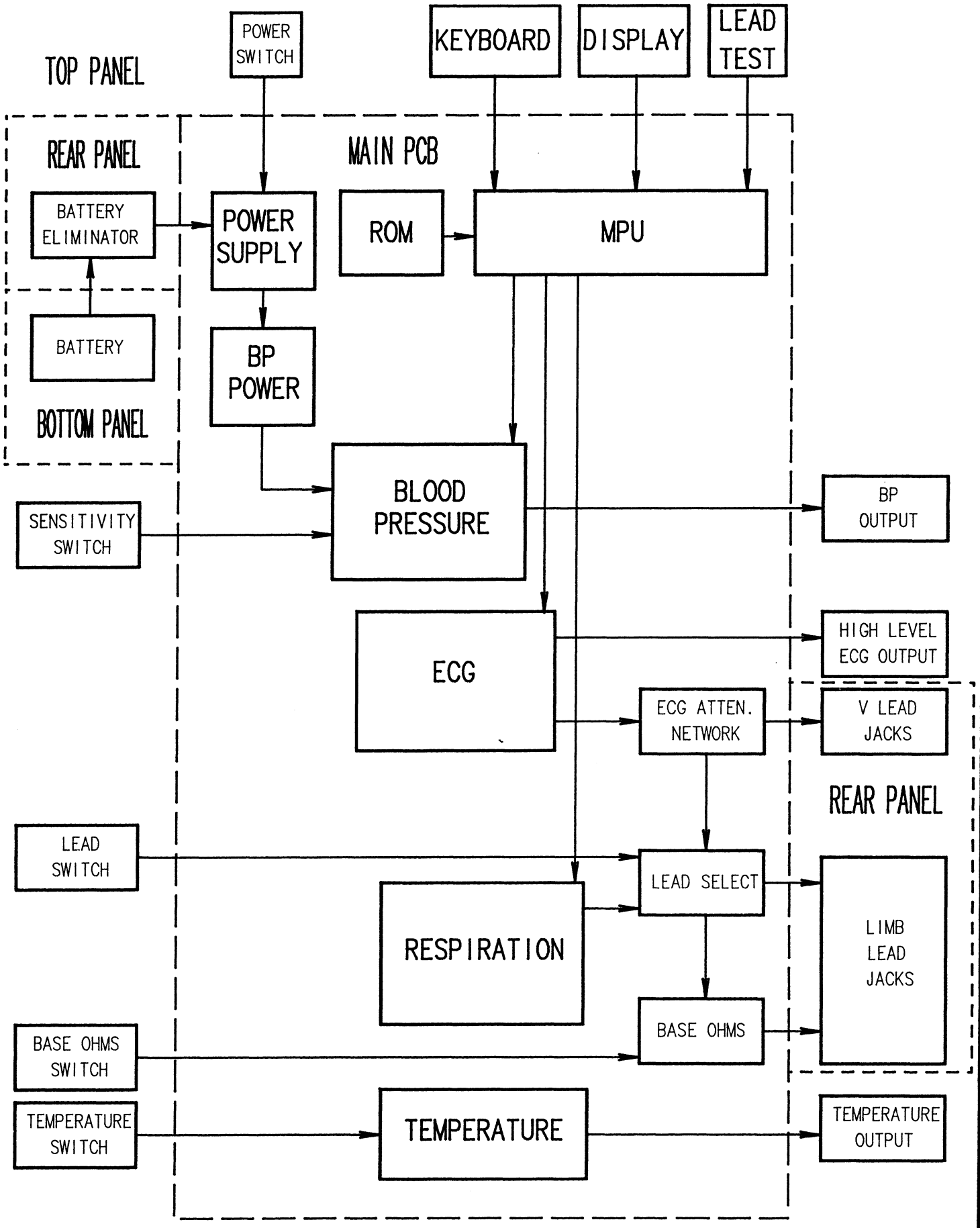


FIGURE 5-1
MODEL 215M BLOCK DIAGRAM

INTRODUCTION

The Model 215M Patient Simulator is a battery powered microprocessor controlled device with a two digit liquid crystal display.

Schematic 1 shows the microprocessor, power supplies, switch PCB, display, and temperature simulation circuit.

Schematic 2 contains the blood pressure and ECG circuitry, and rear panel jacks.

BLOCK DIAGRAM DESCRIPTION

Refer to figure 5-1 for the block diagram. Words in CAPITAL LETTERS in the following text refer to blocks in the block diagram.

The POWER SWITCH connects the BATTERY (or battery eliminator) to the POWER SUPPLIES. Information from the KEYBOARD instructs the MPU which function to execute. The number of the selected function is shown on the DISPLAY. The MPU uses the programmed information from ROM to control the Model 215M. The MPU controls operation of the BLOOD PRESSURE, ECG, and RESPIRATION circuitry.

The BLOOD PRESSURE circuit processes data from the MPU and sends it to the BP OUTPUT. The BP SENSITIVITY switch determines the uV/V/mmHg output sensitivity of the BLOOD PRESSURE circuit.

The ECG circuit processes data from the MPU which is output at the HIGH LEVEL ECG OUTPUT jack. Another signal from the ECG circuit is routed to the ECG ATTENUATION NETWORK before being output at the V LEAD and LIMB LEAD JACKS.

The LEAD SWITCH determines which ECG LIMB LEADS the RESPIRATION signal will be output to. The BASE OHMS SWITCH sets the output resistance of the LIMB LEADS to be either 500Ω or 1KΩ.

The setting of the TEMPERATURE SWITCH determines which temperature the TEMPERATURE circuit will simulate.

Shorting the LEAD TEST terminals together with a good ecg lead will cause the MPU to flash the DISPLAY.

CIRCUIT DESCRIPTION

SCHEMATIC 1 OF 2

POWER SUPPLIES

The power supply consists of U1, U2, D1, C1, C2, C3, and C4. The Model 215M patient simulator is a battery operated unit that uses either a 9.0 volt battery or battery eliminator (connections for battery and eliminator shown on schematic 2).

U1 is a low power voltage regulator. D1 protects U1 and U2 in the event the battery is connected to the unit backwards. C1 helps reduce noise to the voltage input at U1-8. The input voltage is then regulated to +5.0V at U1-1. If the battery voltage goes too low (approximately 6 volts), the voltage level at pin 5 will go low. This signal will instruct the CPU to flash the display. At all other times, the signal at U1-5 is pulled to +5V by R80.

U2 is a voltage inverter that switches a positive voltage to a corresponding negative voltage. C3 charges to the input voltage (at pin 8) which is internally transferred from a positive voltage to a negative voltage. This voltage is then output to pin 5 of U2. C4 reduces the output ripple. The negative voltage is then used by the ECG and respiration op amps.

ISOLATED BLOOD PRESSURE POWER SUPPLY

The blood pressure power supply consists of components T1, U3, Q1, Q2, C5-C9, and R10. This supply generates +5V and -5V for use in the blood pressure circuitry only.

The components Q1, Q2, C6, and C7 create an oscillator circuit at the primary winding of transformer T1 (pins 4, 6, 9, and feedback winding, pins 1, 2, and 3) C5 and R10 set the operating current. T1 then steps the primary voltage up at the secondary winding. U3 rectifies the square wave output at T1 to +5Vdc and -5Vdc. C8 and C9 act as filter caps to eliminate any voltage spikes.

CONTROLLING CIRCUITRY

This circuit is composed of U7, U6, Y1, J3, J4, SWITCH PCB, and related components.

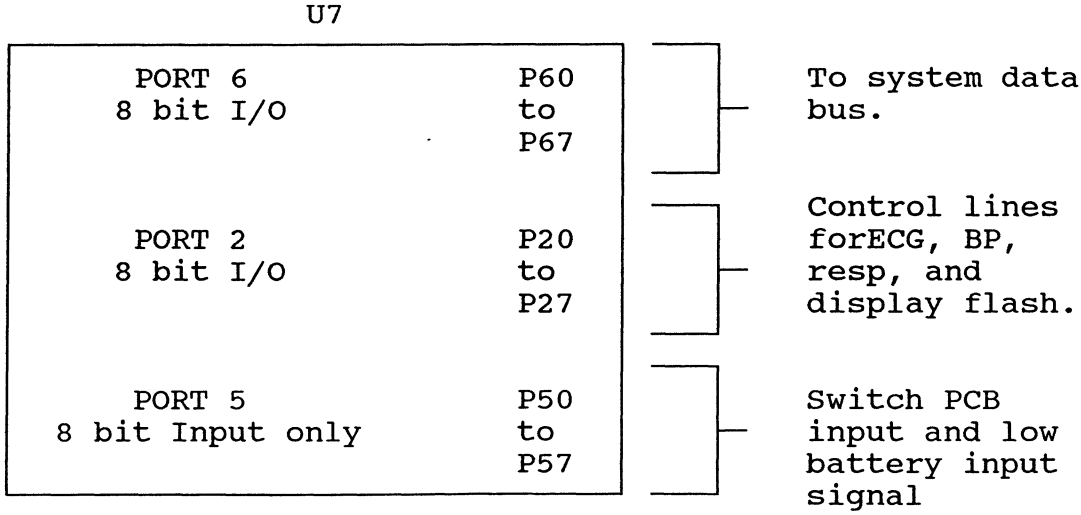
MICROPROCESSOR (U7)

The Model 215M is controlled by an HD63A03XP CMOS 8-bit Micro Processing Unit (MPU). This IC features 192 bytes of RAM and 24 parallel I/O pins: 16 I/O pins at Ports 2 and 6; 8 input pins at Port 5.

The MPU is powered by VCC and VSS (pins 33, 1, and 42). VCC requires +5V (+4.50V - +5.50V) and VSS is tied to ground. The system clock is derived from the crystal Y1 and the MPU. Y1 oscillates at a frequency of 4MHz which is then divided down to 1MHz internally by the MPU.

D2, R67, and C14 comprise the MPU reset circuit. When the Model 215M is powered up, current through R67 will begin to charge C14. The active low RST (U7-6) line remains low until C14 charges and causes it to go high, thereby initiating MPU operation. A delayed reset after powerup insures that all the circuitry has stabilized before the MPU starts.

Three I/O ports are configured as follows:



MEMORY (U6)

Software containing information to run the Model 215M resides at U6, a 32Kx8 ultraviolet erasable, electrically programmable read only memory (ROM). A decoupling capacitor, C10, is connected from VCC to GND to suppress voltage peaks, and prevent possible damage to the memory. U6 is the only ROM sending data to the MPU. There is no need, therefore, to ever strobe the chip select line (CS, U6-20), so this line is tied to ground. A low signal to the memory request line (MR, U6-22) will initiate data read by the MPU.

KEYBOARD

Port 5 of the MPU (P51 - P57) is the input port for the keyboard. These lines will be pulled high by RN1 (resistor network 1) until one of the keys (function, select, or execute) on the front panel of the Model 215M is pressed, connecting that line to ground. The MPU continually strobes the Port 5 inputs, looking for a low signal from the keyboard.

DISPLAY

The display circuit contains U4, U5, and DS1.

U4 and U5 are two BCD-to-seven segment latch/decoder/ drivers required to operate the two digit liquid crystal display (LCD). The MPU will send an active high signal to the latch enable (LE) input of each driver. This will allow the BCD (binary coded decimal) data from Port 6 of the MPU to be latched in at pins 5, 3, 2, and 4 of each decoder. U4 drives the MSD (most significant digit) and U5 the LSD (least significant digit).

A 0V to +5V, 60 Hz square wave generated by the MPU is sent to pins 1, 2, 6, and 18 of the display (DS1) to drive the background of the LCD. The same 60 Hz square wave is also sent to the phase input (PH) at pin 6 of each of the decoders (U4 and U5). The phase input will reverse the phase of the A-G outputs of the decoders in relation to the phase of the LCD background. Example: when the phase of the "A" output of a decoder is opposite that of the LCD background, the "A" segment of the digit will be turned on, or be darker than the background.

TEMPERATURE SIMULATION

A parallel resistor network comprises the temperature circuit which simulates temperature thermistors used in the patient.

LEAD TEST

Connecting a good ECG cable or lead across the lead test terminals J3 and J4 will effectively short the two terminals together. This will cause the input to U7-9 to go low, instructing the MPU to flash the display. If the test lead is open, J3 and 4 will not be shorted together and the signal line at U7-9 will be pulled to +5V by R81.

SCHEMATIC 2 OF 2

POWER INPUT

BATTERY AND BATTERY ELIMINATOR

Connections for unit power input on the rear panel are at J6, pins 13 and 15. J17 is the connector for the battery eliminator, which is located on the rear panel. J18 is the connector for the battery, located in the battery compartment on the bottom of the unit.

BLOOD PRESSURE

The blood pressure circuit has been designed to be electrically isolated from the ECG circuitry in order to eliminate any ground return interference or offset problems caused by monitors. The major components comprising the blood pressure circuit are U8, U9, and S7.

DAC

U8 is a 12 bit multiplying digital to analog converter (DAC) that interfaces directly with the MPU.

Digital data is input to the D0 - D7 pins of U8, with D0 being the LSB and D7 the MSB. Connecting the chip select input (CS) to BP ground enables Write 1 (WR1). WR1 is an active low input that enables the loading of data at D0-D7 into the internal input latch of the chip.

U8 is capable of processing 12 bits of information. Since only 8 data lines are connected to the IC, the byte select control line (B1/B2) determines the order in which data is latched into the IC. When B1/B2 is high, the first 8 bits of data are latched. When B1/B2 is low, the remaining bits are latched.

Write 2 (WR2) enables data transfer from the input latch to the output latch of the IC once both input bytes have been latched. The data inputs are capacitively coupled to maintain BP circuit isolation. C25 provides a return current path for these capacitors.

A reference voltage (VREF) for DAC operation is supplied by the positive exciter voltage from the blood pressure monitor probe connected to the Model 215M top panel BP input. This reference voltage may be any where from 2 to 16Vac or dc. RFB input is an internal feedback resistor for the op amp U9.

OUT1 (U8-11) supplies current to op amp U9. The reference voltage is multiplied by the data from the data bus to produce the current output at OUT1.

SIGNAL AMPLIFICATION

An LF441A low power, low offset voltage, JFET-input operational amplifier (U9), takes the current output of the D to A converter and produces a voltage output proportional to the current input. The voltage is adjustable through R11, (BP AMPL) then attenuated according to the sensitivity switch setting. When switch S7 is set to 40uV/V/mmHg, output signal is attenuated by the voltage divider of R12 and R15. Setting S7 to 5uV/V/mmHg results in signal attenuation by R12, R13, and R14.

The 40uV/V/mmHg setting results in each exciter volt being equal to 40uV/mmHg. Example: if the exciter voltage input at J1-3 (+EXC) was 5V, the output at J1-1 (-OUT) will be 20uV/mmHg if the unit is set to output 100mmHg. If the switch is set to 5uV/V/mmHg, the output would be 2.5uV/mmHg.

ECG

The ECG circuit is formed by U10, U11, U12A and B, and the ECG posts on the rear panel.

DAC

U10 (this description will also apply to U15) is an 8 bit digital to analog converter which interfaces directly with the microprocessor. The MPU transmits data via the data bus to the U10 data input pins D0-D7. Data is loaded into the DAC's internal register whenever WR1 is low and LF is high concurrently.

OUT1 outputs current to op amp U11. The current output is determined by multiplying the reference voltage by the data input to U10.

SIGNAL AMPLIFICATION

The current signal from U10 (OUT1) is processed by U11 and U12A. The voltage output of these op amps is adjusted by R16 (ECG AMPL).

Resistors R68-R79 constitute the attenuation network for the ECG waveform at V1-V6, and R30, R34, and R38-R40 form an attenuation network for the limb leads.

HIGH LEVEL OUTPUT

U12B utilizes the ECG waveform signal at the output of U11 and data information from the MPU to develop the 1V high level ECG output at J17.

The PACE control line generated at the MPU introduces a voltage spike to the ECG circuit that simulates a pacemaker spike.

RESPIRATION

The respiration waveform is generated by U15, U14, U13, and PR1A and PR1B.

DAC

D to A conversion by U15 is the same as that of U10. Refer to description under ECG DAC.

SIGNAL AMPLIFICATION

Op amp U14 produces a voltage output at pin 6 proportional to the current input at pin 2. Signal amplitude is set by R85 (RESP AMPL) and R57. The signal is then sent to the inverting input of U13. U13 determines the amount of current through two photoisolators, PR1A and PR1B. The light emitted by the LED's is proportional to the amount of current flowing through them from the output of U13. The resistance of the photoresistors then varies in proportion to the light generated by the diodes. In this manner, the voltage output from U13 is converted to a resistance that varies to simulate respiration. The signal is then routed to the selected ECG lead.

S8, the lead selection switch, determines whether the respiration signal goes to LL or LA. Resistors R30, 34, 38, 40, and 39 form the network by which baseline ohms is determined. This can be either 1KΩ or 500Ω as selected by the BASE Ω switch S9.

SECTION 6

PARTS LIST

MAIN BOARD ASSEMBLY

REF DEG	PART NO.	DESCRIPTION	QUANT
C001	0401-0007	CAP DIP 1.0 µF 35V	1
C002	0401-0015	CAP DIP 10 µF 25V	1
C003	0403-0052	CAP ELECT 6.8 µF 50V	1
C004	0403-0017	CAP ELECT 68 µF 25V	1
C005	0418-0008	CAP CERM .1 µF 50V	1
C006	0403-0052	CAP ELECT 6.8 µF 50V	1
C007	0418-0008	CAP CERM .1 µF 50V	1
C008	0403-0052	CAP ELECT 6.8 µF 50V	1
C009	0403-0052	CAP ELECT 6.8 µF 50V	1
C010	0418-0008	CAP CERM .1 µF 50V	1
C011	0418-0008	CAP CERM .1 µF 50V	1
C012	0415-0012	CAP MICA 18 pF 300V	1
C013	0415-0012	CAP MICA 18 pF 300V	1
C014	0401-0014	CAP DIP 22 µF 16V	1
C015	0418-0073	CAP CERM .0047 µF 50V	1
C016	0418-0073	CAP CERM .0047 µF 50V	1
C017	0418-0073	CAP CERM .0047 µF 50V	1
C018	0418-0073	CAP CERM .0047 µF 50V	1
C019	0418-0073	CAP CERM .0047 µF 50V	1
C020	0418-0073	CAP CERM .0047 µF 50V	1
C021	0418-0073	CAP CERM .0047 µF 50V	1
C022	0418-0073	CAP CERM .0047 µF 50V	1
C023	0418-0073	CAP CERM .0047 µF 50V	1
C024	0418-0073	CAP CERM .0047 µF 50V	1
C025	0418-0071	CAP CERM .56 µF 50V	1
C026	0418-0008	CAP CERM .1 µF 50V	1
C027	0418-0008	CAP CERM .1 µF 50V	1
C028	0418-0074	CAP CERM .033 µF 50V	1
C029	0418-0008	CAP CERM .1 µF 50V	1
C030	0418-0008	CAP CERM .1 µF 50V	1
C031	0418-0008	CAP CERM .1 µF 50V	1
C032	0418-0016	CAP CERM .001 µF 50V	1
C033	0418-0008	CAP CERM .1 µF 50V	1
C034	0418-0008	CAP CERM .1 µF 50V	1
C035	0418-0073	CAP CERA .0047 µF 50V	1
D001	2101-0002	DIODE 1N4001	1
D002	2101-0010	DIODE 1N914	1
D003	2102-0037	TRANSORB 20V BYPOLAR	1
D004	2102-0039	LM385Z-1.2 VOLTAGE REF TO-92	1
DS01	2410-0015	DISPLAY LCD 2 DIGIT	1
J001	2710-0169	JACK DIN BP 5 PIN	1
J002	2710-0171	JACK DIN TEMP 4 PIN	1
J003	5015-0093	212B ECG STUD	1
J004	2719-0210	TIP JACK UNINSUL'D 1/4-32 THD	1
J005	2710-0187	2 PIN PCB MT .1SPC	1
J006	2710-0172	M HEADER RA 15 PIN	1
PR01	2116-0016	PHOTO ISO, MATCHED PAIR	1
Q001	2111-0021	TRANS NPN 2N2484	1
Q002	2111-0021	TRANS NPN 2N2484	1

REF DEG	PART NO.	DESCRIPTION	QUANT
R001	0300-1106	RES CF 1/4W 5% 1 MΩ	1
R002	0300-1106	RES CF 1/4W 5% 1 MΩ	1
R003	0300-1106	RES CF 1/4W 5% 1 MΩ	1
R004	0300-1106	RES CF 1/4W 5% 1 MΩ	1
R005	0300-1106	RES CF 1/4W 5% 1 MΩ	1
R006	0300-1106	RES CF 1/4W 5% 1 MΩ	1
R007	0309-1941	RES MF 1/2W 1% 93.1 Ω	1
R008	0308-1731	RES MF 1/4W 1% 56.2 Ω	1
R009	0309-1182	RES MF 1/2W 1% 150 Ω	1
R010	0300-1274	RES CF 1/4W 5% 27 KΩ	1
R011	0326-0122	RES VAR 10% 1/2W 25T 1KΩ	1
R012	0307-1563	RES MF 1/8W 1% 3.74 KΩ	1
R013	0316-0200	RES MF 1/8W .1% 2.32 KΩ	1
R014	0316-0199	RES MF 1/8W .1% 332 Ω	1
R015	0307-1552	RES MF 1/8W 1% 365 Ω	1
R016	0326-0125	RES VAR 10% 1/2W 25T 10KΩ	1
R017	0307-1594	RES MF 1/8W 1% 40.2 KΩ	1
R018	0307-1594	RES MF 1/8W 1% 40.2 KΩ	1
R019	0307-1884	RES MF 1/8W 1% 80.6 KΩ	1
R020	0307-1864	RES MF 1/8W 1% 76.8 KΩ	1
R021	0307-1225	RES MF 1/8W 1% 165 KΩ	1
R022	0307-1683	RES MF 1/8W 1% 4.99 KΩ	1
R023	0300-1124	RES CF 1/4W 5% 12 KΩ	1
R024	0307-1594	RES MF 1/8W 1% 40.2 KΩ	1
R025	0307-1884	RES MF 1/8W 1% 80.6 KΩ	1
R026	0307-1393	RES MF 1/8W 1% 2.49 KΩ	1
R027	0307-1444	RES MF 1/8W 1% 28 KΩ	1
R028	0307-1242	RES MF 1/8W 1% 174 Ω	1
R029	0307-1851	RES MF 1/8W 1% 75 Ω	1
R030	0307-1392	RES MF 1/8W 1% 249 Ω	1
R031	0307-1054	RES MF 1/8W 1% 11 KΩ	1
R032	0307-1851	RES MF 1/8W 1% 75 Ω	1
R033	0307-1242	RES MF 1/8W 1% 174 Ω	1
R034	0307-1392	RES MF 1/8W 1% 249 Ω	1
R035	0307-1154	RES MF 1/8W 1% 14 KΩ	1
R036	0307-1851	RES MF 1/8W 1% 75 Ω	1
R037	0307-1302	RES MF 1/8W 1% 200 Ω	1
R038	0307-1392	RES MF 1/8W 1% 249 Ω	1
R039	0307-1392	RES MF 1/8W 1% 249 Ω	1
R040	0307-1392	RES MF 1/8W 1% 249 Ω	1
R041	0300-1104	RES CF 1/4W 5% 10 KΩ	1
R042	0300-1104	RES CF 1/4W 5% 10 KΩ	1
R043	0300-1104	RES CF 1/4W 5% 10 KΩ	1
R044	0300-1104	RES CF 1/4W 5% 10 KΩ	1
R045	0300-1104	RES CF 1/4W 5% 10 KΩ	1
R046	0307-1964	RES MF 1/8W 1% 97.6 KΩ	1
R047	0307-1303	RES MF 1/8W 1% 2 KΩ	1
R048	0316-0195	RES MF 1/8W .5% 1.78 KΩ	1
R049	0316-0196	RES MF 1/8W .5% 1.33 KΩ	1
R050	0316-0197	RES MF 1/8W .5% 1.18 KΩ	1
R051	0316-0189	RES MF 1/8W .5% 23.7 KΩ	1

REF DEG	PART NO.	DESCRIPTION	QUANT
R052	0316-0190	RES MF 1/8W .5% 17.8 KΩ	1
R053	0316-0191	RES MF 1/8W .5% 15.8 KΩ	1
R054	0316-0192	RES MF 1/8W .5% 4.75 KΩ	1
R055	0316-0193	RES MF 1/8W .5% 3.57 KΩ	1
R056	0316-0194	RES MF 1/8W .5% 3.16 KΩ	1
R057	0307-1904	RES MF 1/8W 1% 84.5 KΩ	1
R058	0307-1774	RES MF 1/8W 1% 61.9 KΩ	1
R059	0300-1102	RES MF 1/4W 5% 100 Ω	1
R060	0307-1493	RES MF 1/8W 1% 3.16 KΩ	1
R061	0307-1531	RES MF 1/8W 1% 34.8 Ω	1
R062	0307-1391	RES MF 1/8W 1% 24.9 Ω	1
R063	0307-1301	RES MF 1/8W 1% 20 Ω	1
R064	0307-1742	RES MF 1/8W 1% 576 Ω	1
R065	0307-1602	RES MF 1/8W 1% 412 Ω	1
R066	0307-1532	RES MF 1/8W 1% 348 Ω	1
R067	0300-1104	RES CF 1/4W 5% 10 KΩ	1
R068	0307-1884	RES MF 1/8W 1% 80.6 KΩ	1
R069	0307-1682	RES MF 1/8W 1% 499 Ω	1
R070	0307-1794	RES MF 1/8W 1% 64.9 KΩ	1
R071	0307-1682	RES MF 1/8W 1% 499 Ω	1
R072	0307-1714	RES MF 1/8W 1% 53.6 KΩ	1
R073	0307-1682	RES MF 1/8W 1% 499 Ω	1
R074	0307-1664	RES MF 1/8W 1% 47.5 KΩ	1
R075	0307-1682	RES MF 1/8W 1% 499 Ω	1
R076	0307-1714	RES MF 1/8W 1% 53.6 KΩ	1
R077	0307-1682	RES MF 1/8W 1% 499 Ω	1
R078	0307-1794	RES MF 1/8W 1% 64.9 KΩ	1
R079	0307-1682	RES MF 1/8W 1% 499 Ω	1
R080	0300-1104	RES CF 1/4W 5% 10 KΩ	1
R081	0300-1104	RES CF 1/4W 5% 10 KΩ	1
R082	0307-1901	RES MF 1/8W 1% 84.5 Ω	1
R083	0307-1591	RES MF 1/8W 1% 40.2 Ω	1
R084	0307-1541	RES MF 1/8W 1% 35.7 Ω	1
R085	0326-0114	RES VAR 10% 1/2W 25T 100 KΩ	1
R086	0300-1106	RES CF 1/4W 5% 1 MΩ	1
RN02	0317-0029	RES NET 1M X 5 SIP	1
RN03	0317-0029	RES NET 1M X 5 SIP	1
S001	2507-0018	SW SLIDE 4P2T	1
S007	2507-0018	SW SLIDE 4P2T	1
S008	2507-0018	SW SLIDE 4P2T	1
S009	2507-0018	SW SLIDE 4P2T	1
S010	2507-0019	SW SLIDE 4P3T	1
T001	1210-0001	ISO XFMR DC-DC	1
TP01	2714-0002	TEST POINT TERMINAL	1
TP02	2714-0002	TEST POINT TERMINAL	1
U001	2118-0112	IC LP2951CN	1
U002	2118-0113	IC ICL7660CPA	1
U003	2103-0005	DIODE BRIDGE VM-18 1A 100V DI	1
U004	2120-0100	IC 74HC4543N	1
U005	2120-0100	IC 74HC4543N	1
U006	2122-0126	IC EPROM PROGMD U6 215M	1

R087
R088

R00 MF
Y8W 1% 101

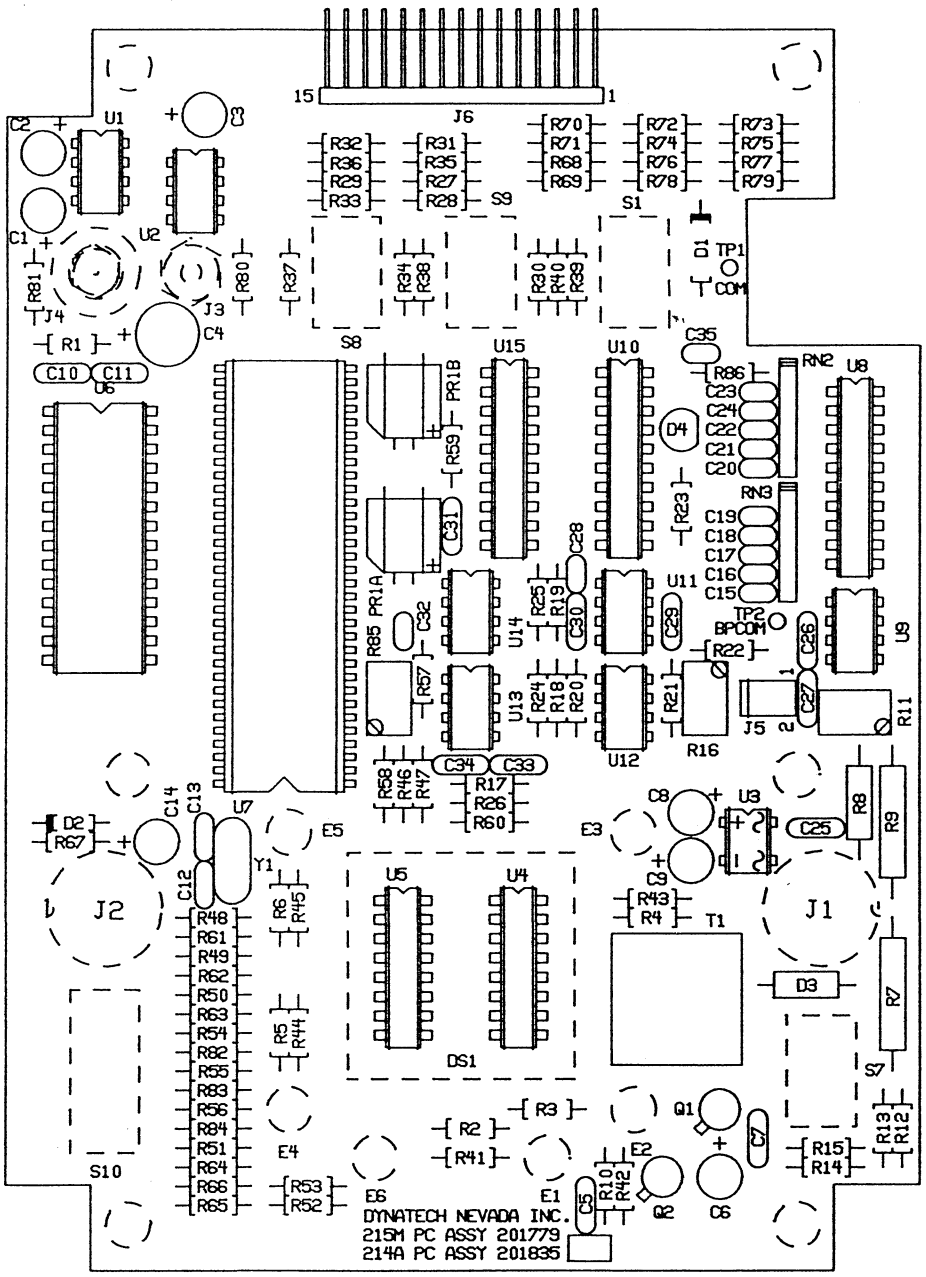
REF DEG	PART NO.	DESCRIPTION	QUANT
U007	2122-0061	IC μPROCESSOR 63A03X	1
U008	2122-0064	IC DAC1232LCD	1
U009	2118-0115	~~IC LF441ACN~~ IC LF442ACN Dual op amp	1
U010	2121-0051	IC DAC0830LCN	1
U011	2118-0136	IC LF441CN	1
U012	2118-0116	IC LF442CN DUAL OP AMP	1
U013	2118-0136	IC LF441CN OP AMP	1
U014	2118-0136	IC LF441CN OP AMP	1
U015	2121-0051	IC DAC0830LCN	1
Y001	1220-0012	CRYSTAL 4.00 MHZ	1
ZZ01	4910-0097	SW STD #6 RD .25L BRS	6
ZZ02	4713-0049	STANDOFF SWAGE IN #6 9/16 LG	1
ZZ03	5015-0222	STANDOFF SWAGE IN .662" 1/4-32	1
ZZ04	2712-0003	IC SKT 8 PIN DIP LP	7
ZZ06	2712-0018	IC SKT 16 PIN DIP LP	2
ZZ07	2712-0017	IC SKT 20 PIN DIP LP	3
ZZ08	2712-0023	IC SKT 28 PIN DIP LP	1
ZZ09	2712-0037	SCKT IC 64 PIN	1
ZZ10	2712-0050	SOCKET DISPLAY 215M	1
ZZ11	5201-0261	215M MAIN PCB - BASIC	1
ZZ12	5205-0264	215M SWITCH PCB ASSY	1
ZZ13	4704-2233	SCREW PPH 4-40 X 1/4	6
ZZ14	4711-0115	WASHER INT/TTH TYPE A #4	6

REF DEG	PART NO.	DESCRIPTION	QUANT
REAR PANEL ASSEMBLY			
J001	1002-0008	CONN BATTERY 9V	1
J002	2719-0204	PHONE JACK MINI	1
J003	4919-0055	ECG POST, GRN (RL)	1
J004	4919-0056	ECG POST, WHT (RA)	1
J005	4919-0052	ECG POST, BLK (LA)	1
J006	4919-0054	ECG POST, RED (LL)	1
J007	4919-0053	ECG POST, BRN (V1)	1
J008	4919-0053	ECG POST, BRN (V2)	1
J009	4919-0053	ECG POST, BRN (V3)	1
J010	4919-0053	ECG POST, BRN (V4)	1
J011	4919-0053	ECG POST, BRN (V5)	1
J012	4919-0053	ECG POST, BRN (V6)	1
P001	2710-0163	F HEADER 15 PIN SIP	1
ZZ01	5001-0310	215M REAR DATA PANEL	1
ZZ02	5201-0262	215M REAR PCB - BASIC	1
ZZ03	5023-0081	BINDING POST MTG BASE GREY	10
ZZ04	5207-0138	215M RR PANEL SPACER BAR	2
ZZ05	3003-0501	WIRE BROWN #24 2"LG	1
ZZ06	3003-0504	WIRE YELLOW #24 2"LG	1
ZZ07	3003-0503	WIRE ORANGE #24 2"LG	1
ZZ08	4919-0065	INSERT BINDING POST	10
ZZ09	4711-0121	LOCKWASHER #8	10
ZZ10	4711-9705	HEX NUT #8	10
SWITCH PCB ASSEMBLY			
S002	2505-0028	SWITCH OBROUND P/B BLACK	1
S003	2505-0028	SWITCH OBROUND P/B BLACK	1
S004	2505-0028	SWITCH OBROUND P/B BLACK	1
S005	2505-0028	SWITCH OBROUND P/B BLACK	1
S006	2505-0028	SWITCH OBROUND P/B BLACK	1
ZZ01	5201-0264	215M SWITCH PCB - BASIC	1
ZZ02	4910-0103	STANDOFF SWAGE IN #4 1/8" LG	6

REF DEG	PART NO.	DESCRIPTION	QUANT
FINAL ASSEMBLY			
J001	2719-0203	PHONE JACK	1
P001	2711-0003	CONN I/P 2 PIN BODY	1
ZZ01	5205-0261	215M MAIN PCB ASSY	1
ZZ02	5210-0193	215M REAR PANEL ELEC ASSY	1
ZZ03	5027-0137	215M BOTTOM COVER MODIF	1
ZZ04	5027-0136	215M TOP COVER MODIF	1
ZZ05	5027-0166	215M FRONT PANEL	1
ZZ06	5001-0307	215M TOP DATA LABEL	1
ZZ07	5023-0071	BATTERY COMPARTMENT	1
ZZ08	3003-0502	WIRE RED #24 3.5" LG	1
ZZ09	3003-0500	WIRE BLK #24 3.5" LG	1
ZZ10	4904-0007	FOOT RUBBER	4
ZZ11	4715-0021	SCRW 4-20 X 9/16 HEX	6
ZZ12	4709-0004	SCRW 3M X 30M PIT PAN	4
ZZ13	4711-4015	WASHER FLAT TYP A #4	4
ZZ14	4711-4019	WASHER FLAT TYP A #6	4
SHIPPING SYSTEM			
ZZ02	9301-0058	BOX 9x9x5	1
ZZ03	9508-0182	215M MANUAL	1
ZZ04	9519-0163	215M PATIENT SIM FINAL ASSY	1
ZZ05	9530-0011	111A,113A SOFT CARRYING CASE	1

SECTION 7

SCHEMATICS



COMPONENT SIDE

FIGURE 7-1

COMPONENT LOCATOR

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
C	INCORP ECO 582 - CHG R57, R58, R85 VALUES	11/90	JTW

BATT PWR IN — POWER — S1 — D1 1N4001 — C1 1UF

U1 2951: IN, OUT, SNC, ERR, 5V, FB, GND — C2 10UF — +5V

U2 7660: CAP+, CAP−, VOUT — C3 6.8UF — C4 6.8UF — −V — TP1

C12 18PF — Y1 4MHz — C13 18PF — C11 0.1UF — V_{CC} — XTAL — EXTAL

R81 10K — R1 1M — LEAD TEST TOP PANEL J3 J4

C10 0.1UF — V_{PP}

U6 27256: A15–A0, D7–D0, $\overline{MR}$, $\overline{CS}$, GND

U7 6303X: MP_0, $\overline{STDBY}$, $\overline{NM1}$, $\overline{RST}$, V_{SS}, V_{SS}, MP1

D2 1N914 — R67 10K — C14 22UF

P60–P67 (D0–D7) — P20–P27 — P50–P57

R80 10K

R2–R6 1M — R41–R45 10K

SWITCH PCB PCB 201806

S6	E1	EXECUTE
S2	E2	FUNCTION ▼
S3	E3	FUNCTION ▲
S4	E4	SELECT ▼
S5	E5	SELECT ▲
	E6	

U4 4543 — U5 4543 — DS1 DISPLAY

S10 TEMP — J2

R48 1.78K	R61 34.8	30	
R49 1.33K	R62 24.9	37	
R50 1.18K	R63 20	40	
R51 23.7K	R64 576	30	T2
R52 17.8K	R65 412	37	
R53 15.8K	R66 348	40	
R54 4.75K	R82 84.5	30	T1
R55 3.57K	R83 40.2	37	
R56 3.16K	R84 35.7	40	

J2: 1 400, 3 T2, 2 T1, 4 COM — TEMP TOP PANEL

DATA BUS — B1/$\overline{B2}$ — PACE — $\overline{ECGW}$ — $\overline{BPPW1}$ — $\overline{RW}$ — $\overline{BPW2}$

T1 — C5 0.1UF — R10 27K — Q1 2N2484 — Q2 2N2484 — C6 6.8UF — C7 0.1UF — BP

U3 VM18 — TP2 — C8 6.8UF — C9 6.8UF — $+5V_{BP}$ — $-5V_{BP}$

(FILE: 201833C1.SCH)

TOLERANCES	APPROVALS BY	DATE	DYNATECH NEVADA INC
X.X - ± 0.1	JTW	6/90	TITLE SCHEMATIC DIAGRAM 215M/214A PATIENT SIMULATOR
X.XX - ± 0.01		7/16/90	
X.XXX - ± 0.005		11/90	SIZE B — DWG. NO. 201833 — REV C
FRACTIONS ±1/64			SCALE NONE — SHEET 1 OF 2
ANGLES ±1/2°			

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
C	INCORP ECO 582 - CHG R57, R58, R85 VALUES	11/90	JTW

DATA BUS

+5V_BP

U8 1232 — U9 LF441 — BP AMPL

R7 93.1, 1/2W; R8 56.2 1/4W; R9 150 1/2W; D3 SA20CA

J1 — BP TOP PANEL: +EXC, -EXC, +OUT, -OUT

R11 1K; R12 3.74K; R13 2.32K 0.1%; R14 332 0.1%; R15 365; S7 40/5

C25 .56UF; C26 0.1UF; C27 0.1UF

U12B LF442 — R21 165K; R22 4.99K; J5 P5; J17 — HIGH LEVEL TOP PANEL

U10 1232 — U11 LF441 — ECG AMPL

R16 10K; R18 40.2K; R19 80.6K; R20 76.8K; R23 12K; R24 40.2K; R25 80.6K

U12A LF442

U15 1232 — U14 LF441 — RESP AMPL

D4 LM385

R85 100K; R57 84.5K; R46 97.6K; R47 2K; R58 61.9K; R59 100; C31 0.1UF; C32 .001UF; C33 0.1UF; C34 0.1UF

PR1A; PR1B

R17 40.2K; R26 2.49K; R60 3.16K

R27 28.0K; R28 174; R29 75; R31 11.0K; R32 75; R33 174; R35 14.0K; R36 75; R37 200

S8 LEAD

S9 1K/500

R30 249; R34 249; R38 249; R40 249; R39 249

R68 80.6K; R69 499; R70 64.9K; R71 499; R72 53.6K; R73 499; R74 47.5K; R75 499; R76 53.6K; R77 499; R78 64.9K; R79 499

J6 P6 — BATT PWR IN

J7 V1; J8 V2; J9 V3; J10 V4; J11 V5; J12 V6; J13 RA; J14 LL; J15 LA; J16 RL

REAR PANEL PCB

J17 BATTERY ELIMINATOR — REAR PANEL: E1 (YEL), E2 (ORN), E3 (BRN), E4 (RED), E5 (BLK)

J18 — 9V BATTERY — BOTTOM PANEL

BPW1; BPW2; B1/B2; ECGW; PACE; RW

(FILE: 201833C2.SCH)

TOLERANCES	APPROVALS BY	DATE
X.X - ± 0.1		
X.XX - ± 0.01	JTW	6/90
X.XXX - ± 0.005		
FRACTIONS ±1/64		
ANGLES ±1/2°		

DYNATECH NEVADA INC

TITLE: SCHEMATIC DIAGRAM 215M/214A PATIENT SIMULATOR

SIZE B | DWG. NO. 201833 | REV D

SCALE NONE | SHEET 2 OF 2

DAMAGE and SHORTAGE

Before you fully unpack any unit *READ THIS* for your protection.
(This information applies only to shipments within the United States).

DAMAGE

This shipment was packaged and delivered to the carrier with the utmost care to insure safe delivery of goods. When shipment is received and signed for by the transportation company, consignor's responsibility ceases. Do not accept shipment which evidences damage or shortage until agent of carrier endorses a statement of the irregularity on the face of the transportation receipt. Without documentary evidence, a claim cannot be filed.

CONCEALED DAMAGE

The Interstate Commerce Commission has indicated that a carrier is as much responsible for concealed damage as for visible damage in transit. Upon receipt of shipment, promptly unpack it and check thoroughly. If concealed damage is discovered, cease further unpacking and request immediate inspection by local agent of carrier. A written report of the agent's findings, with signature, is necessary to support claim.

SHORTAGE

Check shipment against shipping papers. Do not discard packing materials or packing cases until contents have been found to be correct. The removal of items before shipment has been checked may create a shortage. Check all possibilities before reporting a shortage.

CLAIMS

If your agent or carrier has been given an opportunity to inspect the shipment, any claim for a shortage or damaged merchandise can be handled as a simple and routine procedure. Claims must be filed by consignee. Shipping terms are F.O.B. Carson City, Nevada unless otherwise specified.

LOSS

In the event of complete loss, claim will be handled in the same manner as for Shipping Damage or Shortage.

SHIPPING DAMAGE / SHORTAGE

AIR FREIGHT

A claim must be initiated at point of destination. A claim must be filed by submitting a letter on company stationery with an explanation of the extent of damage or loss and forwarded with a copy of the original* air bill, and original invoice or photostat of same, to the airline which carried the shipment.

*Upon request, photostatic copies of original papers held by Dynatech Nevada required in support of claims will be made available.

PARCEL POST / UPS

PLACING CLAIM FOR DAMAGE

For those shipments insured by Parcel Post, the addressee initiates the claim by filling out Post Office Dept. Form 3812, "Request for Payment of Domestic Postal Insurance". Item 12 is to be other than Post Office of Address for inspection. A new purchase order is required by Dynatech Nevada to cover the cost of repairs (or in the case of loss or refiling-replacement order). Damaged material will be repaired and returned. Party named in item 12 of form 3812 will receive reimbursement for repair cost from Post Office Department.

PLACING CLAIM FOR LOSS

In the event of a report to consignor of loss or refiling, Post Office Department Form 3812 will be initiated by Dynatech Nevada at point of origin. If, after Post Office investigation, the material is not located, disposition from this point will be the same as stated in the previous paragraph - "Placing claim for damage".

PLACING CLAIM FOR DAMAGE TO SHIPMENTS BY UNITED PARCEL

The addressee must notify Dynatech Nevada, who will notify United Parcel Service giving the shipper's number and date parcel was shipped. United Parcel Service will send a representative to inspect the damage and advise proper disposition. A new purchase order is required by Dynatech Nevada to cover the cost of repairs or in the case of loss or refiling, a replacement order. Damaged material will be repaired and returned.

.H:...$$MO/DA/YE FILENAME.EXT$$

REVISIONS

LTR	PAGE	DESCRIPTION	DATE	REV BY
1	ALL	RELEASE TO PRODUCTION	1-94	GLA

NOTES: 1. APPROPRIATE NOTES

PART NUMBER	DESCRIPTION	ITEM	QTY	DRAWING NO.
9519-0140	21A CALIBRATION PROCEDURE	1	X	200304E.CAL

FILE:200304E.CAL

DYNATECH NEVADA INC.		
21A TEST/CALIBRATION PROCEDURE		
PART NO. 9519-0140	DRAWING: 200304 REV: 1	
CE	PE	PAGE 1 of 8

TEST DEPARTMENT, MANUAL TEST PROCEDURE
Rev. 1

I. TITLE

21A Top PCB test procedure.

II. SCOPE

This procedure covers inspection, test and verification of the 21A Top PCB.

III. EQUIPMENT NEEDED

* 217A TEST UNIT
* 21A TEST UNIT
* KEITHLEY MODEL 196 DMM OR EQUIV

TEST CABLES

* DUAL BANANA TO CLIP DMM TEST LEADS
* TEST & CALIBRATION INTERFACE CABLE

IV. VISUAL

1. Inspect the board for loose screws, solder bridges, neatness, cleanliness, component polarity, missing parts, broken parts, bent parts, crooked parts, foam tape under crystal, straightness of switches and connectors and whatever.
* Make sure socketed ICs are properly SEATED with no pins out.

2. Check that the Display PCB is mounted and soldered properly and that the center-bottom tab is bent away from the traces on the UUT board.

V. SETUP

1. Connect the UUT to the 21A Bottom PCB by mating the connector on the bottom of the PCBs.

2. Connect the test 217A and the UUT together with the INTERFACE CABLE.

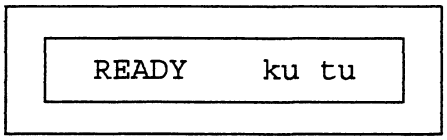
V. TEST PROCEDURE

1. Turn on the power to the test 217A (which in turn supplies power to the UUT).
< Observe "WAIT", followed by "Ready ku tu" on the UUT display >

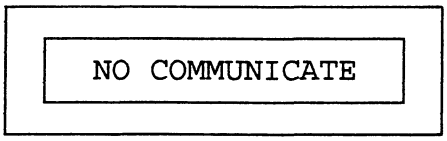
3. Connect a volt meter to TP1 and TP3(low). Measure 5V.

4. Connect the volt meter to TP3(low) and TP2. Measure -5V.

5. A few seconds after power up the top board display should read:



If it reads:

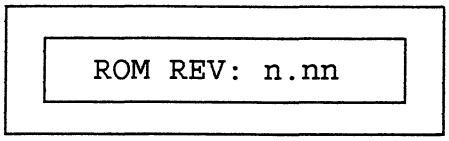


There is a malfunction in the system, it needs repair.

6. Enter The following key sequence:

SPEC | 0 | A

The display should read:

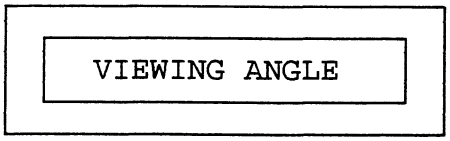


Be sure this number matches the number printed on the ROM.

7. Enter The following key sequence:

SPEC | 0 | 1

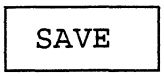
The display should read:



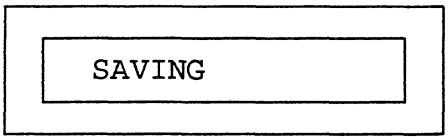
Adjust the angle as desired, by repeatedly pressing:

DN OR UP

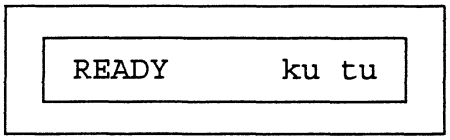
Then press:



The display should read:

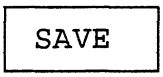


After a few seconds the display should return to:

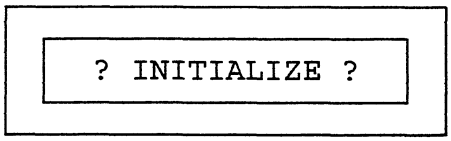


[NOTE : DON'T DO steps 8 & 9 on customer service units.]

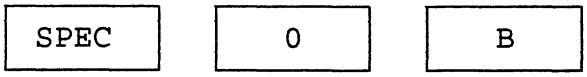
8. Turn the power off. Depress and hold:



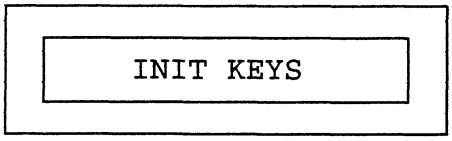
While still holding the key, turn the power on.
After the display reads:



Press:

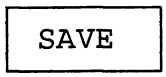


The display should read:

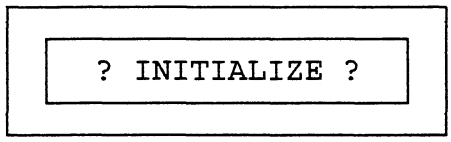


After it is through initializing the keys it will return to the ready prompt.

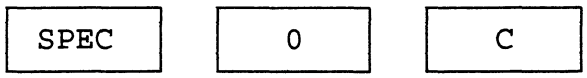
9. Turn the power off. Depress and hold:



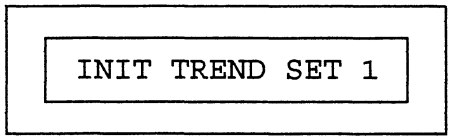
While still holding the key turn the power on. After the display reads:



Press:



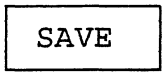
The display should read:



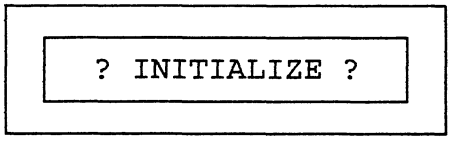
After it is through initializing the trends it will return to the ready prompt.

CALIBRATION--

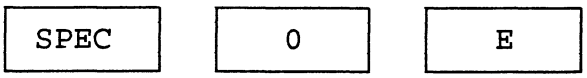
10. Turn the power off. Depress and hold:



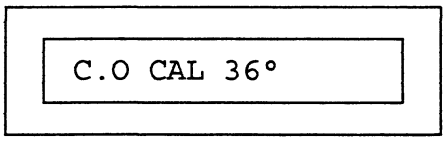
While still holding the key, turn the power on. After the display reads:



Press:



The display should read:



DMM TO OHMS, 3 MEG SCALE. (or whatever scale has approx 10μA current source)
Connect the baseline temperature leads on the test fixture cable to an ohmmeter. Adjust for 15.85kΩ by repeatedly pressing:

[NOTE : Temperature leads are the two red wires on test cable.]

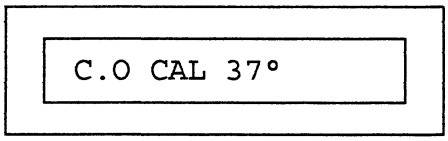
DN OR UP

[NOTE : UP key decreases the ohms, DOWN key increases the ohms. Temperature is inversely proportional to ohms.]

11. Press:

SAVE

The display should read:



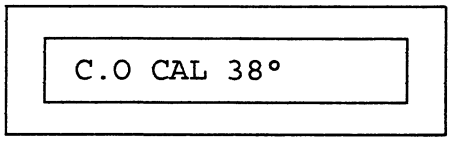
Adjust for 15.33kΩ by repeatedly pressing:

DN OR UP

12. Press:

SAVE

The display should read:



Adjust for 14.83kΩ by repeatedly pressing:

DN	OR	UP

Press:

SAVE

The display will return to the ready prompt.

DMM TO OHMS, 300K SCALE.

13. Connect the DMM to the INJECTATE TEMPERATURE LEADS on the test fixture cable. Set the INJECTATE TEMPERATURE SWITCH (S1) TO 20° (up). Turn the adjustment Pot. (R12) to both ends to be sure it has a range of <1KΩ to >90KΩ

14. Set the INJECTATE TEMPERATURE SWITCH (s1) to 2° (down). Turn the adjustment Pot. (R13) to both ends to be sure it has a range of <1KΩ to >90KΩ.

15. Press:

80BPM

The display should read:

ECG BPM 80

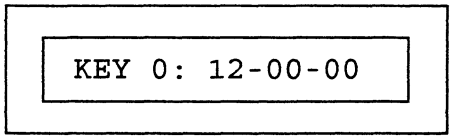
The patient simulator display should read the same thing in lower case.

Repeat this for the next 14 keys.

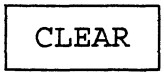
16. Press:

REVIEW	0

The display should read:



Press:



END OF PROCEDURE

..BOTTOM OF FILE

FROM: Robert Munoz **DATE:** 6/7/96

EQUIPMENT FIELD NOTE

SHIP VIA:

☐ US Mail	☐ Fax	☐ FedX - 2nd Day	☐ FedX - Std. Overnight	☐ FedX - P1 Next AM

STATUS:

☐ ASAP - Hot!!!!	☐ Within 24 Hours	☐ Routine

COMPLAINT REPORT FILED? ☐ YES ☒ NO

SALES REPRESENTATIVE: Summit Instrume

ACCOUNT NAME:	**Sibley Memorial Hosp**
DEPARTMENT:	
TITLE:	**Cath Lab Chief**
ADDRESS 1:	**5255 Loughboro Road NW**
ADDRESS 2:	
CITY, STATE, ZIP:	**Washington, DC 20016**
COUNTRY:	**U.S.A.**
MAIN CONTACT:	**Michael Dixon**
TELEPHONE 1:	**(202)537-4162, EXT:**
TELEPHONE 2:	**( ) -, EXT:**
FAX NUMBER:	**(202)364-7638**

NOTES:

*** ROBERTM *** December 24, 1996 at 8:46am
Ron called and said his 21A sn 00774 he just got back from repair is still giving him a cardiac output error. He will be returning it for warranty repair.

*** BILLG *** May 8, 1996 at 7:45am
Spoke with Mr. Dixon regaring the 214B lit that we sent. They will be putting the simulator into the budget for later this year.

*** BILLG *** April 4, 1996 at 9:33am
Please resend the lit for the 214B to Micheal Dixon .

*** GAILM *** February 16, 1996 at 1:31pm
Please send 214B literature per MED sales lead.

*** BILLG *** January 29, 1996 at 1:44pm
Attempted a followup left a message.